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Ethnicity and variation in prognosis for patients newly hospitalised for heart failure: a matched historical cohort study

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Objectives: To compare mortality and factors predictive for outcome in age matched white and South Asian cohorts after first admission for heart failure.

Design: Matched historical cohort study.

Setting: One National Health Service trust comprising three acute care hospitals.

Participants: 176 South Asian (mean age 68 (10) years, 45% women) and 352 age and sex matched white (70 (11) years, 42% women) patients hospitalised for the first time with heart failure.

Main outcome measures: All cause survival, measures of disease severity, and the association of clinical variables with outcome.

Results: Compared with white patients, South Asian patients had similar rates of prior coronary heart disease but more often had prior hypertension (45% v 33%, $p = 0.006$) and diabetes (46% v 18%, $p < 0.0001$). Atrial fibrillation (15% v 31%, $p = 0.0002$) and prior diuretic use (39% v 48%, $p = 0.041$) were less common among South Asians. Left ventricular function was more often preserved (38% v 23%, $p = 0.002$) and less often severely impaired (18% v 28%, $p = 0.025$) among South Asians. During follow up (range 520–1880 days) 73 of 176 (41.2%) South Asian and 167 of 352 (47.4%) white patients died. South Asian ethnicity was associated with lower all cause mortality (odds ratio 0.71, 95% confidence interval 0.53 to 0.96, $p = 0.02$). Other predictors of outcome (admission age, lower systolic blood pressure, higher creatinine, higher plasma glucose, and lower haemoglobin) were similar in each cohort.

Conclusions: At first hospitalisation, heart failure appears less advanced in South Asians, among whom diabetes and hypertension are more prevalent. Survival is better for South Asian than for white patients. Higher glucose and lower haemoglobin at admission provide useful prognostic information in heart failure.

As the only manifestation of heart disease which is increasing in prevalence, chronic heart failure (CHF) constitutes an increasingly important public health issue.¹ Conditions contributing to the development of CHF, such as coronary heart disease (CHD) and hypertension, vary in prevalence among ethnic populations, and it has been suggested that important differences may exist among ethnic groups in the response to treatment and prognosis for heart failure.² Reports from the USA suggested that disease prevalence,³ progression,⁴ prognosis,⁴ and the response to pharmacological treatments^{5–6} may be less favourable in black American patients. In contrast, other studies have suggested lower mortality but higher readmission rates among black patients in the USA.⁷

People whose ethnic origin is South Asian (countries of the Indian subcontinent) constitute one of the largest ethnic groups in the world and the largest ethnic minority population in the UK. These populations have high prevalence of CHD and diabetes, factors that may be expected to lead to greater prevalence of CHF. Few studies have examined the prevalence of and outcome from CHF in South Asian patients in the UK. Data from our own⁸ and one other centre⁹ suggest that patients of South Asian ethnicity have about a threefold higher risk of hospitalisation with heart failure than the white population. In our description of the demographic characteristics of patients hospitalised for the first time with heart failure, diabetes, hypertension, and prior myocardial infarction were more prevalent among South Asians. Despite this adverse risk factor profile, in terms of both mortality and readmission outcome was better

among South Asians.⁸ An earlier study noted younger average age among South Asians admitted to hospital with heart failure,⁹ a finding that led to the suggestion that this condition may have earlier onset in this population.² In our study of unselected hospital admissions for heart failure over the period 1998 to 2001, the average age of white patients was 78 years compared with 70 years among South Asians. Thus, it was suggested that our observation of better prognosis for South Asians hospitalised with heart failure is artefactual¹⁰ and simply reflects the age structure of the ethnic South Asian population in the UK.

We wished to explore further our prior observations. The objective of the current study was to compare the clinical characteristics of, and the relative prognosis for, South Asian and white patients hospitalised for the first time with heart failure after correcting for disease severity, access to investigations, and pharmacological treatment in the two populations. We also wished to assess possible aetiological factors in these cohorts.

METHODS

The strategy for patient identification has been described elsewhere.⁸ We used routine hospital discharge data from Leicestershire's health information service to identify, for residents of Leicestershire, all first hospitalisation episodes

Abbreviations: CHARM, candesartan in heart failure assessment of reduction in mortality and morbidity; CHD, coronary heart disease; CHF, chronic heart failure; LV, left ventricular; RENAISSANCE, randomized etanercept North American strategy to study antagonism of cytokines

for which heart failure was coded between 1 April 1998 and 31 March 2001. First admissions were those where patients had no previous heart failure related hospitalisation in a minimum of the preceding five years. Ethnicity, information recorded routinely locally, was that reported in the hospital discharge data. We obtained all available hospital records pertaining to the three local acute care hospital sites, constituting a single acute care National Health Service trust. The validity of the diagnosis required documentation of appropriate symptoms (shortness of breath, peripheral oedema, and fatigue) and physical findings (pulmonary crepitations, peripheral oedema, gallop rhythm, and jugular venous distension). We sought supportive documentation from reports of chest radiography. If doubt remained, an appropriate response after diuretic treatment was accepted. Patients for whom the diagnosis of heart failure on the index admission could not be confirmed were excluded.

A single investigator (JDN) abstracted baseline clinical characteristics, including demographic features, clinical history, physical findings, and biochemical and haematological information relevant to the index heart failure admission. Biochemical and haematological data recorded were the first available from the admission episode. A history of CHD was recorded if the patient had a history of angina, myocardial infarction, or coronary revascularisation. Diabetes was recorded for patients treated with insulin, oral hypoglycaemic drugs, or dietary restriction. Hypertension was recorded for patients with a history of treated hypertension or who were taking antihypertensive treatment. Details of baseline and discharge drug treatment were abstracted from the notes, as was information regarding the timing and findings of echocardiographic examination.

We matched each South Asian patient with two sex and age matched white patients. The principal outcome measure was all cause mortality, identified from death certification records provided by the Office for National Statistics to Leicestershire Health Authority. Survival was measured from

the date of first admission to the date of death. Follow up was censored at 31 March 2003.

Statistical analysis

Crude survival was estimated by the Kaplan-Meier method and Cox proportional hazards modelling was used to assess the influence on outcome of covariates.⁸ Covariates assessed for such an influence were age, prior myocardial infarction, hypertension, renal insufficiency, diabetes, and stroke, and the baseline serological variables sodium, creatinine, haemoglobin, and glucose. To examine for linearity of associations between outcome and continuous variables, these were categorised by quartiles. Missing continuous variables were imputed by the expectation maximisation method based on correlation between each variable with absent values and all other variables as estimated from the set of complete patients. Differences between ethnic groups were examined by the χ^2 test for categorical variables and Mann-Whitney test for continuous variables. Data are presented as mean (SD) for continuous variables and as proportions for categorical variables. Two sided $p < 0.05$ was considered significant.

RESULTS

Demographic characteristics of incident cohort

Between 1 April 1998 and 31 March 2001, a total of 332 first admissions to hospital with heart failure were recorded for South Asian patients. Case records for 210 (63%) were available for review, and these were matched with 419 white patients. The 210 patients for whom case records were available (59% men, mean age 69 years (range 42–93 years), 43% died by end of follow up) did not differ significantly from the 122 for whom case records were not accessed (56% men, $p = 0.556$, mean age 69 years (range 42–96 years, $p = 0.990$), 41% died, $p = 0.739$). On review of the 629 available case notes, evidence was insufficient for a new diagnosis of heart failure for 101 (16%) patients. Thus, the final analysis was based on 528 patients, 176 (33%) of whom

Table 1 Baseline characteristics stratified by ethnic origin

Variable	Whites (n = 352)	South Asians (n = 176)	All (n = 528)	p Value*	Missing values
Demographics					
Age (years)	70 (11)	68 (10.0)	69 (10.5)	0.106	0
Women	147 (42%)	79 (45%)	226 (43%)	0.494	0
Medical history					
Heart failure	44 (13%)	18 (10%)	62 (12%)	0.444	0
Angina	75 (21%)	47 (27%)	122 (23%)	0.165	0
Myocardial infarction	75 (21%)	36 (20%)	111 (21%)	0.821	0
Coronary revascularisation	20 (6%)	10 (6%)	30 (6%)	1.0	0
Hypertension	117 (33%)	80 (45%)	197 (37%)	0.006	0
CVA	37 (11%)	20 (11%)	57 (11%)	0.766	0
Diabetes	62 (18%)	81 (46%)	143 (27%)	<0.0001	0
COPD	38 (11%)	9 (5%)	47 (9%)	0.031	0
Physical examination					
Pulse rate (beats/min)	95 (24.7)	92 (20.8)	94 (23.5)	0.115	40 (7.6%)
SBP (mm Hg)	140 (27.5)	145 (28.4)	142 (27.9)	0.063	59 (11.2%)
DBP (mm Hg)	83 (17.9)	83 (18.0)	83 (17.9)	0.559	58 (11%)
Atrial fibrillation	94 (31)†	24 (15)†	118 (25)†	0.0002	63 (12%)
QRS duration	107 (21.7)†	99 (19.9)†	104 (21.4)†	0.0001	63 (12%)
Biochemical data					
Sodium (mmol/l)	137 (4.6)	137 (4.6)	137 (4.6)	0.149	1 (0.2%)
Potassium (mmol/l)	4.2 (0.71)	4.2 (0.64)	4.2 (0.69)	0.438	1 (0.2%)
Creatinine (μ mol/l)	121 (75.8)	128 (86.3)	123 (79.4)	0.657	1 (0.2%)
Serum glucose (mmol/l)	8.4 (5.2)	9.6 (3.7)	8.8 (4.3)	0.019	96 (8.2%)
Haemoglobin (g/l)					
All	131 (20)	125 (22)	129 (21)	0.002	2 (0.4%)
Males	134 (18)	131 (22)	133 (21)	0.235	1 (0.2%)
Females	126 (21)	117 (20)	123 (19)	0.001	1 (0.2%)

All values are mean (SD) or number (%).

*Difference between whites and South Asians; †465 (88%) patients had an ECG available, 308 (88%) whites and 157 (89%) South Asians.

COPD, chronic obstructive pulmonary disease; CVA, cerebrovascular accident; DBP, diastolic blood pressure; SBP, systolic blood pressure.

Table 2 Admission and discharge treatment after first hospitalisation with heart failure

	Whites (n=352)	South Asians (n=176)	p Value
Admission			
Aspirin	98 (28%)	50 (28%)	0.891
ACEI or ARB	91 (26%)	54 (31%)	0.241
Diuretic	169 (48%)	68 (39%)	0.041
Loop	149 (42%)	61 (35%)	0.090
Thiazide	20 (6%)	7 (4%)	0.402
β Blocker	32 (9%)	34 (19%)	0.001
CCB	56 (16%)	50 (28%)	0.001
Digoxin	31 (9%)	5 (3%)	0.010
Nitrate	34 (10%)	27 (15%)	0.054
Spironolactone	3 (1%)	1 (1%)	1.000
Statin	26 (7%)	9 (5%)	0.322
Discharge			
Aspirin	131 (43%)	79 (51%)	0.139
ACEI or ARB	183 (61%)	101 (65%)	0.386
Diuretic	237 (78%)	115 (74%)	0.289
Loop	235 (78%)	111 (72%)	0.136
Thiazide	2 (1%)	4 (3%)	0.187*
β Blocker	46 (15%)	32 (21%)	0.154
CCB	30 (10%)	35 (22%)	0.0003
Digoxin	65 (22%)	11 (7%)	<0.0001
Nitrate	40 (13%)	35 (20%)	0.012
Spironolactone	21 (7%)	8 (5%)	0.447
Statin	54 (18%)	22 (14%)	0.303

*Fisher's exact test.

ACEI, angiotensin converting enzyme inhibitor; ARB, angiotensin receptor blocker; CCB, calcium channel blocker.

were South Asian (table 1). Follow up ranged from 520–1800 days, with a mean of 1257 days.

Co-morbidity and drug treatment

A history of heart failure was recorded for 10% of South Asian and 13% of white patients. CHD was recorded for about 40% of each cohort. Diabetes and hypertension were more often recorded for South Asians and COPD more often for white patients (table 1). A greater proportion of the South Asian cohort (27% v 20% whites, $p = 0.043$) reported symptom duration of less than 24 hours before hospitalisation. Mean plasma glucose was higher among South Asians. Haemoglobin was lower among South Asian women (table 1). Atrial fibrillation was twice as common in white as in South Asian patients (31% v 15%).

At admission, more South Asians were taking β blockers and calcium antagonists; South Asians also tended to have more nitrates prescribed (table 2). Loop diuretic treatment was uncommon, although more common in the white cohort. In keeping with their greater prevalence of atrial fibrillation, white patients more commonly had digoxin prescribed both at admission and at discharge. Rates of discharge prescription of diuretics, β blockers, and renin-angiotensin system antagonists did not differ at discharge.

Figure 1 Adjusted survival estimates stratified by ethnicity.

Survival

During a mean follow up of 3.5 years, 73 of 176 (41.2%) South Asian and 167 of 352 (47.4%) white patients died. Crude in-hospital, 30 day, one year, and two year survival rates were consistently better for South Asian patients (table 3). For the entire study population, 30 day and one year case fatality rates were 15% and 27%, respectively.

Adjusted survival analysis: influence of ethnicity

Multivariate analysis confirmed an independent association of South Asian ethnicity with better survival (fig 1).

Table 4 shows independent predictors of survival, with continuous variables categorised by quartile. As expected, age and risk of mortality were linearly related. Current prescription of diuretic, higher creatinine, and lower haemoglobin at admission were each associated with adverse outcome. Higher glucose concentrations at admission were associated with poor outcome, and this relation reached significance for concentrations above the highest quartile. For glucose, haemoglobin, and creatinine the strength of association with death was statistically stronger for white patients.

Notably, plasma glucose at admission remained independently predictive of poor outcome among patients discharged without any treatment for diabetes (odds ratio 1.081, 95% confidence interval 1.037 to 1.128, $p = 0.0002$). Indeed among diabetic patients the relation between glucose at admission and subsequent mortality was non-significant (odds ratio 1.018, 95% confidence interval 0.737 to 1.687).

Echocardiography

Sixty nine per cent of patients underwent echocardiographic examination and the timing and findings of this investigation differed between South Asian and white patients (table 5).

Table 3 Unadjusted and adjusted survival estimates for white and South Asian patients

Survival	Unadjusted			Adjusted		
	White	South Asian	All	White	South Asian	All
In hospital	88 (84 to 91)	93 (88 to 96)	89 (86 to 92)	NA	NA	NA
30 days	83 (79 to 87)	90 (85 to 94)	85 (82 to 88)	85 (82 to 88)	91 (87 to 95)	88 (85 to 90)
1 year	70 (65 to 75)	78 (72 to 84)	73 (69 to 83)	73 (68 to 78)	82 (77 to 87)	77 (73 to 81)
2 years	62 (64 to 67)	70 (64 to 77)	65 (61 to 69)	64 (59 to 69)	75 (69 to 81)	68 (64 to 72)

Values are percentage (95% confidence interval (CI)).
NA, not applicable.

Table 4 Independent predictors of all cause mortality

Predictor	HR (95% CI) All	p Value	Whites	South Asians
Ethnicity				
White	1.00		NA	NA
South Asian	0.71 (0.53 to 0.96)	0.020	NA	NA
Age (years)				
<63	1.00		1.00	1.00
63–70	1.597 (1.043 to 2.443)	0.041	1.917 (1.133 to 3.245)	1.039 (0.472 to 2.288)
71–77	1.799 (1.186 to 2.730)	0.008	1.604 (0.951 to 2.703)	1.992 (0.942 to 4.212)
>77	2.136 (1.404 to 3.251)	0.002	1.972 (1.170 to 3.323)	2.251 (1.067 to 4.748)
SBP (mm Hg)				
>158	1.00		1.00	1.00
140–158	1.583 (1.090 to 2.300)	0.022	1.709 (1.065 to 2.743)	1.738 (0.907 to 3.329)
122–139	1.206 (0.801 to 1.816)	0.513	1.369 (0.820 to 2.285)	1.371 (0.650 to 2.890)
<122	1.624 (1.103 to 2.391)	0.017	1.633 (1.023 to 2.605)	1.527 (0.695 to 3.354)
Serum creatinine (μmol/l)				
<85	1.00		1.00	1.00
85–104	1.529 (1.003 to 2.331)	0.089	2.020 (1.191 to 3.427)	0.850 (0.405 to 1.784)
105 to 133	1.444 (0.946 to 2.203)	0.076	1.695 (0.991 to 2.900)	1.093 (0.537 to 2.224)
>133	2.627 (1.746 to 3.951)	<0.0001	4.129 (2.447 to 6.967)	1.158 (0.570 to 2.351)
Serum glucose (mmol/l)				
<6.0	1.00		1.00	1.00
6.0–7.6	1.218 (0.829 to 1.790)	0.285	1.373 (0.866 to 2.179)	0.881 (0.417 to 1.860)
7.7–10.0	1.183 (0.810 to 1.728)	0.313	1.174 (0.750 to 1.838)	1.572 (0.732 to 3.374)
>10.0	2.032 (1.420 to 2.906)	<0.0001	2.474 (1.603 to 3.821)	1.569 (0.789 to 3.118)
Serum haemoglobin (g/l)				
>143	1.00		1.00	1.00
131–143	1.493 (0.989 to 2.255)	0.034	1.467 (0.902 to 2.387)	1.499 (0.641 to 3.506)
116–130	1.620 (1.064 to 2.467)	0.030	1.909 (1.160 to 3.139)	0.964 (0.425 to 2.184)
≤115	1.919 (1.275 to 2.886)	0.002	2.111 (1.288 to 3.462)	1.666 (0.769 to 3.612)
Diuretic on admission	1.300 (1.003 to 1.686)	0.039	1.173 (0.856 to 1.609)	1.616 (0.981 to 2.664)

HR, hazard ratio.

While similar minorities had undergone echocardiography before the index admission, a greater proportion of white patients underwent this examination during, and a smaller proportion after, the index admission. Left ventricular (LV) systolic function was more often reported as normal in the South Asian than in the white cohort (38% *v* 23%, *p* = 0.002). In contrast, severe LV systolic dysfunction was recorded for 28% of white and 18% of South Asian patients (*p* = 0.025).

Figure 2 shows Kaplan-Meier survival curves for patients discharged alive from the index admission. Preserved LV systolic function was associated with better prognosis among patients who underwent echocardiography than among both patients with impaired systolic function and particularly among patients who did not undergo echocardiography.

We considered whether the higher proportion of South Asian patients recorded as having normal LV function may have biased survival in their favour. Our analyses in this regard indicated very similar survival in each cohort for patients with “normal” LV function. Outcome for South Asian patients was driven by better survival for those with moderate or severe LV systolic dysfunction.

DISCUSSION

This study extends our previous report of outcomes for South Asian and white patients with heart failure.⁸ After correcting

for differences in population ages, survival is better for South Asian than for white patients. Heart failure appears to be more advanced in white patients at first hospitalisation.

Figure 2 Kaplan-Meier survival estimates stratified by left ventricular systolic function where known (survivors of index admission only).

Table 5 Echocardiography details

	All	White	South Asian	p Value
Echocardiography performed	364 (69%)	244 (69%)	120 (68%)	0.790
Before admission	51 (14%)	38 (16%)	13 (11%)	0.221
During admission	183 (50%)	131 (54%)	52 (40%)	0.063
After admission	130 (36%)	75 (31%)	55 (46%)	0.005
Normal LV function	102 (28%)	56 (23%)	46 (38%)	0.002
Mild LVSD	85 (23%)	60 (25%)	25 (21%)	0.426
Moderate LVSD	87 (24%)	59 (24%)	28 (23%)	0.859
Severe LVSD	90 (25%)	69 (28%)	21 (18%)	0.025

LV, left ventricular; LVSD, left ventricular systolic dysfunction.

Strengths and limitations of study

This study examined the largest cohort of South Asian patients for whom the hospital discharge diagnosis of heart failure has been verified and for whom clinical information and outcome data are available. The number of patients is large and proportion of events high. Unlike our previous study⁸ this report has the advantage of careful verification of the admission diagnosis and prior medical history through review of hospital records.

While we may have missed cases of heart failure that were not coded as such, this is unlikely to have introduced systematic bias. A significant number of hospital records were not available and a proportion of patients included had not undergone important investigations such as echocardiography. While some data were incomplete, these were split proportionately between cohorts. Moreover, the demographic features of South Asian patients were included and those for whom case records were not available were very similar demographically.

Patient management

Sixty nine per cent of our cohort had undergone echocardiography, a figure similar to that reported from the EuroHeart failure survey 2000 to 2001.¹¹ The poorer prognosis for patients with impaired LV function is in keeping with the results of EuroHeart failure.¹¹ However, among patients discharged alive from the index admission, mortality was highest for patients without documented echocardiographic examination. Perceived futility, death before the investigation, and co-morbidity may all contribute. In this regard the nature of the care of these patients with regard to the specialty of the hospital unit and physician merit further study.

The rates of use of diuretic (75%) and antagonists of the renin-angiotensin system (60%) at discharge are similar to those reported in EuroHeart failure (87% and 62%, respectively).¹² The relatively low rates of prescription of β blockers likely reflect the time period of this study and the difficulties of using these agents in standard CHF populations.

Prognosis of heart failure

We studied relatively young patients age matched to the average of 69 years in the South Asian cohort, younger than the average of 78 years for white patients in our previous report.⁸ Very few of our cohort had a history of heart failure. Nevertheless, case fatality at one year was 27%. This can be compared with the one year case fatality of less than 10% in the recent CHARM (candesartan in heart failure assessment of reduction in mortality and morbidity) trial.¹³ Indeed our observed mortality rate compares closely with that seen in recent trials in advanced heart failure.¹⁴ The significance of this is clear: even at the point of first hospitalisation, the prognosis for heart failure is very poor.

As in non-white populations the risk factor profiles differed between ethnic groups.¹⁵ However, the markers of poor prognosis appear to be very similar for South Asian and white patients. As expected, increasing age, lower systolic blood pressure, and renal impairment were associated with higher case fatality rate. However, we also observed that ethnicity itself, plasma glucose, and anaemia influenced prognosis.

Heart failure: influence of ethnicity

We previously observed that at the time of first hospital admission for heart failure, South Asian patients are younger than their white counterparts.⁸ Findings were similar in a separate study of a small number ($n = 31$) of Indo-Asian patients.¹⁶ For both studies it was suggested that better survival may be the result of younger age in the South Asian

patients.¹⁰⁻¹⁶ Some observations suggest that the better prognosis for South Asian patients more likely reflects less advanced heart failure. Normal LV systolic function was recorded for 38% of South Asians and 23% of white patients. When preserved LV systolic function was defined more broadly¹⁷ (normal or mildly reduced function), this proportion remained higher in South Asians (59%) than in whites (48%). Severe LV systolic dysfunction was less prevalent and surrogate indicators of disease severity suggest less advanced disease among South Asians: symptom duration of less than 24 hours was more common, mean QRS duration shorter, and loop diuretic use at admission less prevalent.

Small UK studies suggested that CHD may be treated less aggressively in South Asians.¹⁸⁻¹⁹ Recent UK prospective studies indicate a higher use of cardiac procedures among South Asians, even allowing for co-morbidity.²⁰ Our observations suggest that in the UK South Asian patients access secondary health care earlier in the course of CHF than do white patients, as seen with angina.²¹ Such a phenomenon may contribute to better survival. Alternatively, or additionally, survival for South Asians may be due to greater prevalence of heart failure with preserved systolic function. The prevalence of hypertension and diabetes among South Asians and the echocardiographic data are in keeping with this. However, our findings were not biased by better survival of South Asian patients with preserved LV function. Rather, survival was better for South Asian patients with "moderate" LV systolic dysfunction on echocardiography. This is likely to reflect the inaccuracy of echocardiographic assessment of LV function and the relative poverty of echocardiography as a prognostic marker.

South Asians were taking both angiotensin converting enzyme inhibitor and β blocker more commonly at presentation. Whether early use of these agents in stable coronary disease results in benefit is controversial; some studies showed benefit²² but others failed to do so.²³ Our data are compatible with the possibility of disease modification by pharmacological treatments known to improve outcome in heart failure.

Glucose and haemoglobin

Our data indicate for the first time that haemoglobin measured at the first hospital admission is a predictor of mortality in an unselected CHF population. Of note is the predictive independence of haemoglobin and creatinine, suggesting anaemia in heart failure to be more than a manifestation of renal impairment, also in keeping with previous studies.²⁴

Applying the World Health Organization criteria of anaemia, haemoglobin < 130 g/l in men and < 120 g/l in women, we observed surprisingly high rates of anaemia of 37% among men in each cohort and 43% among women (52% of South Asian and 38% of white women). In a subset of the RENAISSANCE (randomized etanercept North American strategy to study antagonism of cytokines) trial population, haemoglobin ≤ 120 g/l was seen in only 12% of patients but was associated with poor outcome.²⁵ Dietary habits and haemoglobinopathies are likely to contribute to anaemia in South Asians. In white patients, anaemia is likely due to other causes, possibly as a consequence of more advanced heart failure.

Our observation of plasma glucose at admission as a marker of poor outcome in heart failure is, to our knowledge, novel. Diabetes is a risk factor for the development of heart failure²⁶ and confers worse prognosis once heart failure is established.²⁷ Increased glucose concentrations are associated with increased short term mortality in non-diabetic patients sustaining an ischaemic stroke²⁸ or acute coronary syndromes.²⁹ Other studies have suggested this association to

apply irrespective of diabetic status.³⁰ A previous study of non-diabetic patients with CHF observed no association of random blood glucose concentrations with mortality.³¹

The reasons for the less powerful prognostic value of glucose in diabetics in our study are unclear. The degree of hyperglycaemia may be blunted in diabetic patients receiving antihyperglycaemic treatment. Our observations pertain to glucose concentration rather than diabetic status, which are hampered in our cohort by the lack of standard assessment of glucose tolerance. The correction of anaemia in heart failure may improve prognosis³² and randomised clinical trials of the benefit of correction of anaemia are in progress. Studies of the aggressive control of blood glucose in CHF may be appropriate.

Conclusions

After the first hospital admission with heart failure, survival is better for South Asian than for white patients. The predictors of adverse prognosis are similar in South Asian and white patients. At the time of first admission to hospital South Asian patients are more likely to have preserved LV systolic function and less likely to have advanced heart failure than their white counterparts. Admission concentrations of glucose and haemoglobin provide useful prognostic information in patients hospitalised with heart failure.

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